THE SUN'S ADVOCATE

A solution from Alfa Laval increases the electrical generation time in concentrated solar power plants by 50 percent, making the sun a power source to be reckoned with.

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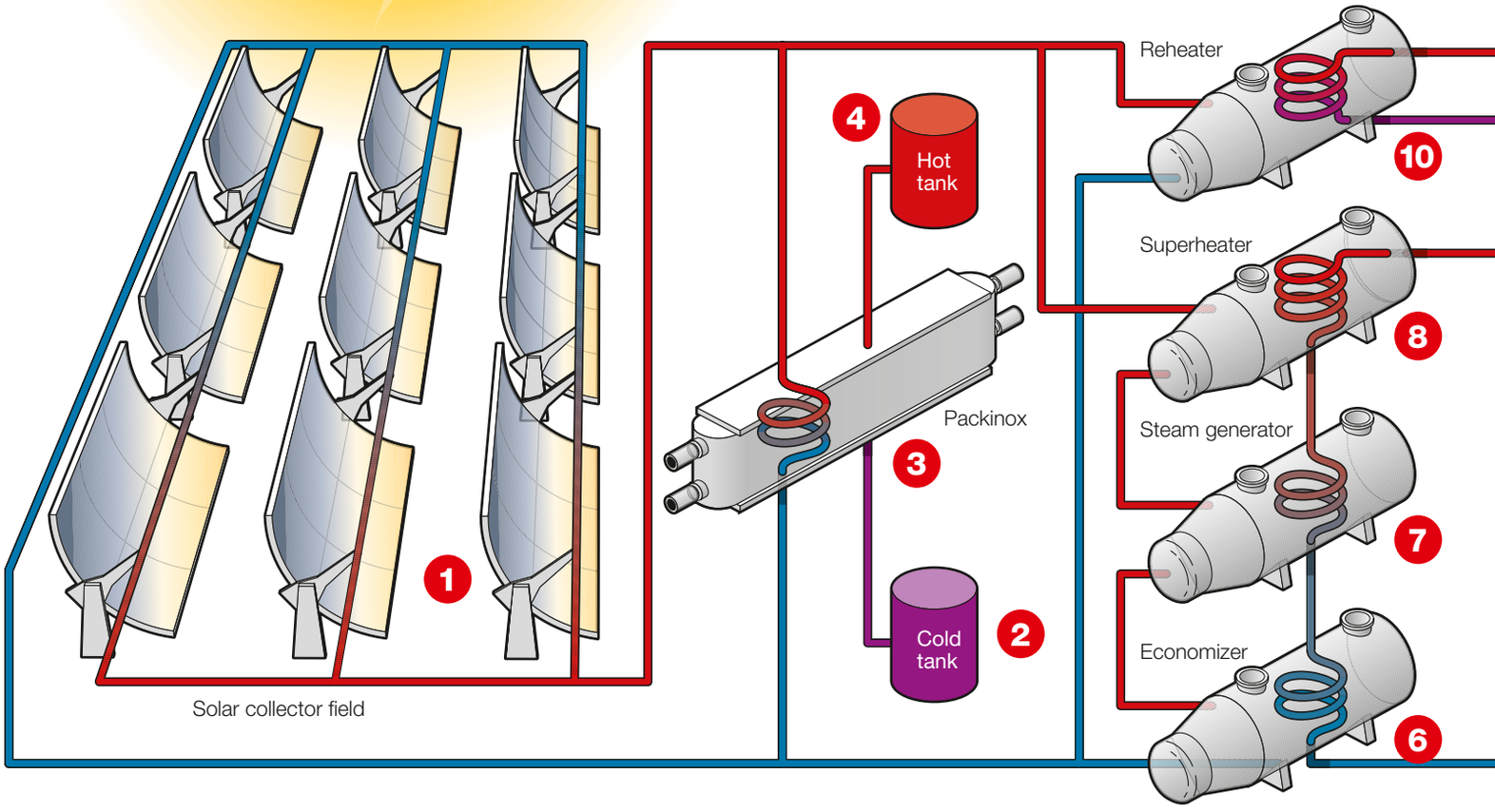
CONCENTRATED SOLAR POWER, or CSP, is one of the two main technologies to produce electricity from the sun's energy. Until recently, CSP has been used to produce electricity only when the sun was up. This has been a problem, since the production does not fully match the typical demand curve for electricity. A solution to the problem is to add a thermal storage system based on molten salt, which allows the plant to generate electricity even when the sky is overcast and after the sun goes down without using a backup system powered by fossil fuels. This means the plant can operate for 18 hours straight instead of 12 hours – an increase of six hours or 50 percent. At the heart of the thermal storage system is an Alfa Laval Packinox heat exchanger specifically developed for this application.

Thanks to recent acquisitions, Alfa Laval can also supply other vital equipment to CSP plants, including a variety of heat exchangers, condensers and dry coolers. ■

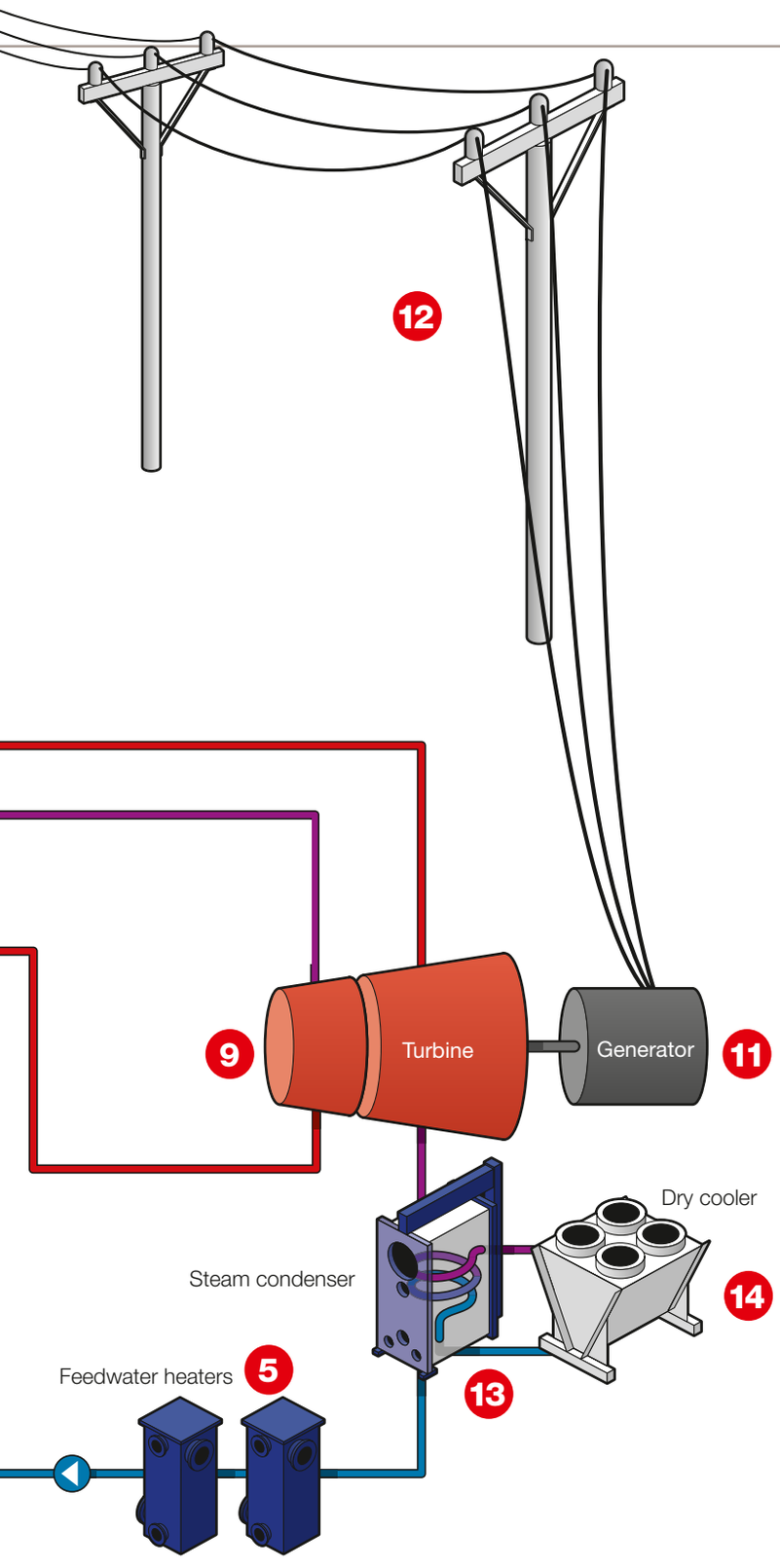


This is how a CSP plant with thermal storage operates

When the sun shines, the solar concentrator field **(1)** heats up a circulating loop of thermal oil. Some of the heated oil is sent directly to the steam generator at the power island for immediate production of electricity. Excess heat is sent in parallel to thermal storage for later use.

During the storage mode, salt is pumped out of the cold storage tank **(2)**, heated by the hot oil in an Alfa Laval Packinox heat exchanger **(3)**, and then stored in the hot salt tank **(4)**. On cloudy days and after sunset, the fluid circulation is reversed: Salt is pumped out of the hot tank, cooled in the oil-to-salt Packinox heat exchanger, then stored in the cold tank. The heat energy contained in the hot salt tank is thereby transferred to the hot oil circuit, which in turn allows the generation of steam and the production of electricity.

In the steam process, water is heated into pressurized steam using a four-step process: First the feedwater heaters **(5)**, then the economizer **(6)** and the steam generator **(7)**, and finally the superheater **(8)**. After going through the first stage of the turbine **(9)**, the steam is reheated in the reheater **(10)** before powering the second stage of the turbine, which in turn drives the generator **(11)** that



produces electricity. The transformer feeds the electricity into the transmission grid **(12)**.

Steam that comes out of the turbine is condensed back into water. Since many CSP plants will be located in desert environments, Alfa Laval offers a solution that minimizes the use of water in this process. It combines an Alfa Laval AlfaCond steam condenser **(13)** and an Alfa Laval dry cooler **(14)**, which uses air instead of water as cooling medium, to handle the vacuum condensing requirement. The only water used circulates in a closed loop running back and forth between the AlfaCond and the dry cooler.

THE ALFA LAVAL TECHNOLOGIES

The Alfa Laval Packinox weighs up to 350 tonnes, and one is usually enough to handle the required length of the thermal storage system.

The Packinox offers better thermal efficiency than shell-and-tube technology, which means more energy can be stored in the same mass of salt, and the steam produced at night will have a lower moisture content, which translates into better-quality steam for producing electricity. The Packinox can also readily accommodate the internal 4 percent volume changes associated with salt freezing and melting. Moreover, the Packinox offers a single pass design that is self-draining. **(3)**

The Alfa Laval Compabloc is a compact plate heat exchanger that combines a range of technological advantages. Its corrugated plate pattern creates an exceptionally high degree of turbulence, which results in outstanding heat transfer efficiency. **(5)**

The Alfa Laval Olmi shell-and-tube heat exchanger is built to withstand high operating temperatures and pressures. Designed to specific customer requirements, this type of heat exchanger is used in a wide range of power plants for heating, evaporating and condensing duties. **(6,7,8,10)**

The Alfa Laval AlfaCond 800 is the world's first plate condenser specifically designed for condensing vapours into liquids at low pressure. **(13)**

The Alfa Laval Fincoil Solar Max G range of dry coolers is especially suitable when high capacities relative to available space, low energy consumption and/or low sound pressures are required. **(14)**